



RF TEST REPORT

Report No.: SET2016-15529

Product Name: Vodafone Mobile WiFi

FCC ID: SRQ-R230

Model No. : MF980,R230

Applicant: ZTE Corporation

Address: ZTE Plaza, Keji Road South, Shenzhen, China

Dates of Testing: 08/20/2016 — 08/30/2016

Issued by: CCIC-SET

Lab Location: Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen, 518055, P. R. China

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Test Report

Product Name : Vodafone Moblie WiFi

Brand Name : ZTE

Trade Name : ZTE

Applicant : ZTE Corporation

Applicant Address : ZTE Plaza, Keji Road South, Shenzhen, China

Manufacturer : ZTE Corporation

Manufacturer Address..... : ZTE Plaza, Keji Road South, Shenzhen, China

Test Standards : 47 CFR Part 15 Subpart E § 15.407
FCC KDB 789033 D02 General UNII Test Procedures
New Rules v01
ANSI C63.10:2013

Test Result..... : PASS

Tested by : 
2016.09.05

Lu Lei, Test Engineer

Reviewed by..... : 
2016.09.05

Zhu Qi, Senior Eginer

Approved by..... : 
2016.09.05

Wu Li'an, Manager

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Change History		
Issue	Date	Reason for change
1.0	2016-09-05	First edition

1. General Information

1.1. EUT Description

EUT Type	Vodafone Moblie WiFi
Hardware Version	dkhA
Software Version	EN_ZTE_MF980V1.0.0B02
EUT supports Radios application	GSM/GPRS/EDGE/WCDMA/HSPA//LTE WLAN2.4GHz 802.11b/g/n WLAN5.0GHz 802.11a/n/ac
Frequency Range	5150 ~ 5250MHz / 5725 ~ 5850MHz
Channel Number	5150 MHz ~ 5250MHz: 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80) 5725 MHz ~ 5850MHz: 5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80)
Bit Rate of Transmitter	802.11a: up to 54Mbps 802.11n up to 300 Mbps 802.11ac: up to 866.7Mbps
Modulation Type	BPSK / QPSK / 16QAM / 64QAM for OFDM 256QAM for OFDM in 11ac mode only
Antenna Type	Internal Antenna
Antenna Gain	Antenna 0:2dBi
	Antenna 1:2dBi
Output Power (Max.)	802.11a: 13.8dBm 802.11n(HT20): 15.5dBm 802.11n(HT40): 14.0dBm 802.11ac(VHT20): 15.5dBm 802.11ac(VHT40): 15.9dBm 802.11ac(VHT80): 15.6dBm

Note1: The EUT is a LTE UFi, it contains 2 models, they are MF980 and R230. They have the same size, appearance and internal structure, and the only difference is the model number.

Note2: The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers for 5GHz WIFI, 2 completed transmitters and 2 receivers for 2.4GHz WIFI.

Note: The EUT incorporates a MIMO function.

Modulation Mode	TX / RX Function
802.11a	1TX / 1RX(SISO)
802.11n (HT20)	1TX / 1RX or 2TX / 2RX(MIMO)
802.11n (HT40)	1TX / 1RX or 2TX / 2RX(MIMO)
802.11ac (VHT20)	1TX / 1RX or 2TX / 2RX(MIMO)
802.11ac (VHT40)	1TX / 1RX or 2TX / 2RX(MIMO)
802.11ac (VHT80)	1TX / 1RX or 2TX / 2RX(MIMO)

Operated band in 5150 MHz ~ 5250MHz

4 channels are provided for 802.11a, 802.11n-HT20, and 802.11ac-VHT20

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n-HT40 and 802.11ac-VHT40

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel are provided for 802.11ac-VHT80

Channel	Frequency	Channel	Frequency
42	5210 MHz	/	/

Operated band in 5725 MHz ~ 5850MHz

5 channels are provided for 802.11a, 802.11n-HT20 and 802.11ac-VHT20

Channel	Frequency	Channel	Frequency
149	5745 MHz	161	5805 MHz
153	5765 MHz	165	5825 MHz
157	5785 MHz	/	/

2 channels are provided for 802.11n-HT40 and 802.11ac-VHT40

Channel	Frequency	Channel	Frequency
151	5755 MHz	159	5795 MHz

1 channel are provided for 802.11ac-VHT80

Channel	Frequency	Channel	Frequency
155	5775 MHz	/	/

1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart E for the EUT FCC Certification:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart E § 15.407	Radio Frequency Devices
2	ANSI C63.10 2013	American National Standard for Testing Unlicensed Wireless Devices
3	ANSI C63.4-2014	American National Standard for Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
4	KDB Publication 789033D02v01	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
5	KDB Publication 662911 D01v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g., MIMO, Smart Antenna, etc)

Test detailed items/section required by FCC rules and results are as below:

No.	FCC Rule	Description	Result
1	15.203	Antenna Requirement	PASS
2	15.407(a)	Peak Output Power	PASS
3	15.407(a) 15.407(e)	Emission Bandwidth	PASS
4	15.407(a)	Power spectral density (PSD)	PASS
5	15.207	AC Power Line Conducted Emission	PASS
6	15.209 15.407(b)	Radiated Band Edges and Spurious Emission	PASS

1.3. Test environment and mode

Operating Environment	
Temperature	24°C
Humidity	57 % RH
Atmospheric Pressure	1010 mbar
Test mode:	
Continuously transmitting mode	Keeps the EUT in 100% duty cycle transmitting with modulation in SISO and MIMO mode, duty cycle factor is not required.

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

For Frequency band 5150 ~ 5250 MHz			
Mode	Modulation scheme / bandwidth		
	5180 MHz	5220 MHz	5240 MHz
802.11a	6 Mbps	6 Mbps	6 Mbps
802.11n/ac – HT20	MCS 0	MCS 0	MCS 0
Frequency	5190 MHz		5230 MHz
802.11n/ac – HT40	MCS 0		MCS 0
Frequency	5210 MHz		
802.11ac – VHT80	MCS 0		

For Frequency band 5725 ~ 5850 MHz			
Mode	Modulation scheme / bandwidth		
	5745 MHz	5785 MHz	5825 MHz
802.11a	6 Mbps	6 Mbps	6 Mbps
802.11n/ac – HT20	MCS 0	MCS 0	MCS 0
Frequency	5755 MHz		5795 MHz
802.11n/ac – HT40	MCS 0		MCS 0
Frequency	5775 MHz		
802.11ac – VHT80	MCS 0		

1.4. Laboratory Facilities

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories

(identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: February 28, 2015. Valid time is until February 27, 2018.

FCC-Registration No.: 317478

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 317478, Renewal date Jul. 18, 2014, valid time is until Jul. 18, 2017.

IC-Registration No.: 5377B

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B on Dec.03, 2014, valid time is until Dec.03, 2017.

2. 47 CFR Part 15C Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

And according to FCC 47 CFR Section 15.247(c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

2.1.2. Antenna Information

Antenna Category: Internal antenna

An Internal antenna was soldered to the antenna port of EUT via an adaptor cable, can't be removed.

Antenna System	Cyclic Delay Diversity(CDD)
	2 antennas are correlated with each other

2.1.3. Antenna Gain

EUT	Antenna	Ant. Type	Gain(dBi)
Vodafone Moblie WiFi	0	Internal	2.0
Vodafone Moblie WiFi	1	Internal	2.0
Vodafone Moblie WiFi	0+1	Internal	5.0

Note: 1. for 802.11n/ac mode, antenna 0, 1 can transmit/receive simultaneously (MIMO mode), for 802.11a, both antennas 0, 1 can transmit/receive at single mode (SISO mode)

$$2. \text{ Directional gain} = G_{ANT} + 10 \log(N_{ANT}) \text{ dBi}$$

2.1.4. Result: comply

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

2.2. Peak Output Power

2.2.1. Limit of Peak Output Power

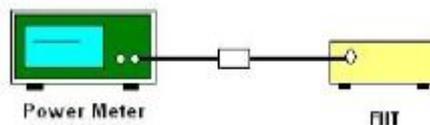
Band	EUT Category	Limit
U-NII-1	<input type="checkbox"/> Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p \leq 125mW(21dBm) at any elevation angle above 30 degrees as measured from the horizon)
	<input type="checkbox"/> Fixed point-to-point Access device	1 Watt (30 dBm)
	<input type="checkbox"/> Indoor Access Point	1 Watt (30 dBm)
	<input checked="" type="checkbox"/> Mobile and portable client device	250mW (24 dBm)
U-NII-2A	<input type="checkbox"/>	250mW (24 dBm) or 11dBm+10logB*
U-NII-2C	<input type="checkbox"/>	250mW (24 dBm) or 11dBm+10logB*
U-NII-3	<input checked="" type="checkbox"/>	1 Watt (30 dBm)

B* is the 26 dB emission bandwidth in megahertz.

2.2.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.2.3. Test Setup



2.2.4. Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

2.2.5. Test Result

Test results of band U-NII-1 (5150 ~ 5250 MHz)

802.11a mode					
Test Frequency (MHz)	Conducted Output Power (dBm)		Limit (dBm)	Result	
	Antenna 0	Antenna 1			
5180	12.6	11.9	24	PASS	
5220	12.9	12.3	24	PASS	
5240	12.9	12.3	24	PASS	
802.11n-HT20 mode					
Test Frequency (MHz)	Conducted Output Power (dBm)			Limit (dBm)	Result
	Antenna 0	Antenna 1	Total		
5180	11.6	11.0	14.4	24	PASS
5220	11.9	11.2	14.6	24	PASS
5240	12.0	11.3	14.7	24	PASS
802.11n-HT40 mode					
Test Frequency (MHz)	Conducted Output Power (dBm)			Limit (dBm)	Result
	Antenna 0	Antenna 1	Total		
5190	10.2	9.9	13.1	24	PASS
5230	10.5	10.1	13.3	24	PASS
802.11ac-VHT20 mode					
Test Frequency (MHz)	Conducted Output Power (dBm)			Limit (dBm)	Result
	Antenna 0	Antenna 1	Total		
5180	11.5	10.7	14.1	24	PASS
5220	11.8	11.0	14.4	24	PASS
5240	11.7	11.0	14.4	24	PASS
802.11ac-VHT40 mode					
Test Frequency (MHz)	Conducted Output Power (dBm)			Limit (dBm)	Result
	Antenna 0	Antenna 1	Total		
5190	11.7	11.3	14.5	24	PASS
5230	11.9	11.5	14.7	24	PASS
802.11ac-VHT80 mode					
Test Frequency (MHz)	Conducted Output Power (dBm)			Limit (dBm)	Result
	Antenna 0	Antenna 1	Total		
5210	11.7	11.4	14.6	24	PASS

Test results of band U-NII-3 (5725 ~ 5850 MHz)

802.11a mode						
Test Frequency (MHz)	Conducted Output Power (dBm)		Limit (dBm)	Result		
	Antenna 0	Antenna 1				
5745	13.6	13.8	30	PASS		
5785	13.6	13.7	30	PASS		
5825	13.4	13.8	30	PASS		
802.11n-HT20 mode						
Test Frequency (MHz)	Conducted Output Power (dBm)			Limit (dBm)	Result	
	Antenna 0	Antenna 1	Total			
5745	12.5	12.5	15.5	30	PASS	
5785	12.3	12.6	15.3	30	PASS	
5825	12.2	12.2	15.2	30	PASS	
802.11n-HT40 mode						
Test Frequency (MHz)	Conducted Output Power (dBm)			Limit (dBm)	Result	
	Antenna 0	Antenna 1	Total			
5755	10.9	11.0	14.0	30	PASS	
5795	10.8	11.2	14.0	30	PASS	
802.11ac-VHT20 mode						
Test Frequency (MHz)	Conducted Output Power (dBm)			Limit (dBm)	Result	
	Antenna 0	Antenna 1	Total			
5745	12.5	12.5	15.5	30	PASS	
5785	12.4	12.5	15.5	30	PASS	
5825	12.2	12.5	15.4	30	PASS	
802.11ac-VHT40 mode						
Test Frequency (MHz)	Conducted Output Power (dBm)			Limit (dBm)	Result	
	Antenna 0	Antenna 1	Total			
5755	12.6	13.1	15.9	30	PASS	
5795	12.5	13.2	15.9	30	PASS	
802.11ac-VHT80 mode						
Test Frequency (MHz)	Conducted Output Power (dBm)			Limit (dBm)	Result	
	Antenna 0	Antenna 1	Total			
5775	12.3	12.9	15.6	30	PASS	

Note: All data rates are testing, but the worse case data rate was record in the report.

2.3. Emission Bandwidth

2.3.1. Limit of Bandwidth

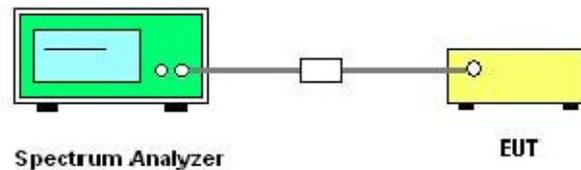
There is no limit bandwidth for band U-NII-1, U-NII-2-A and U-NII-2-C.

The minimum of 6dB bandwidth measurement is 0.5 MHz for U-NII-3.

2.3.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.3.3. Test Setup



2.3.4. Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. For 26dB bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = approximately 1%EBW, VBW > RBW, Detector = Peak, Trace mode = max hold
Span > 26 dB bandwidth and Sweep time = auto
5. Mark the peak frequency and -26dB (upper and lower) frequency.
6. For 6 Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 100kHz
VBW = 300 kHz, Detector = Peak, Trace mode = max hold
7. Mark the peak frequency and -6dB (upper and lower) frequency.
8. Measure and record the worst results in the test report.

2.3.5. Test Results Bandwidth

Test results of band U-NII-1 (5150 ~ 5250 MHz)

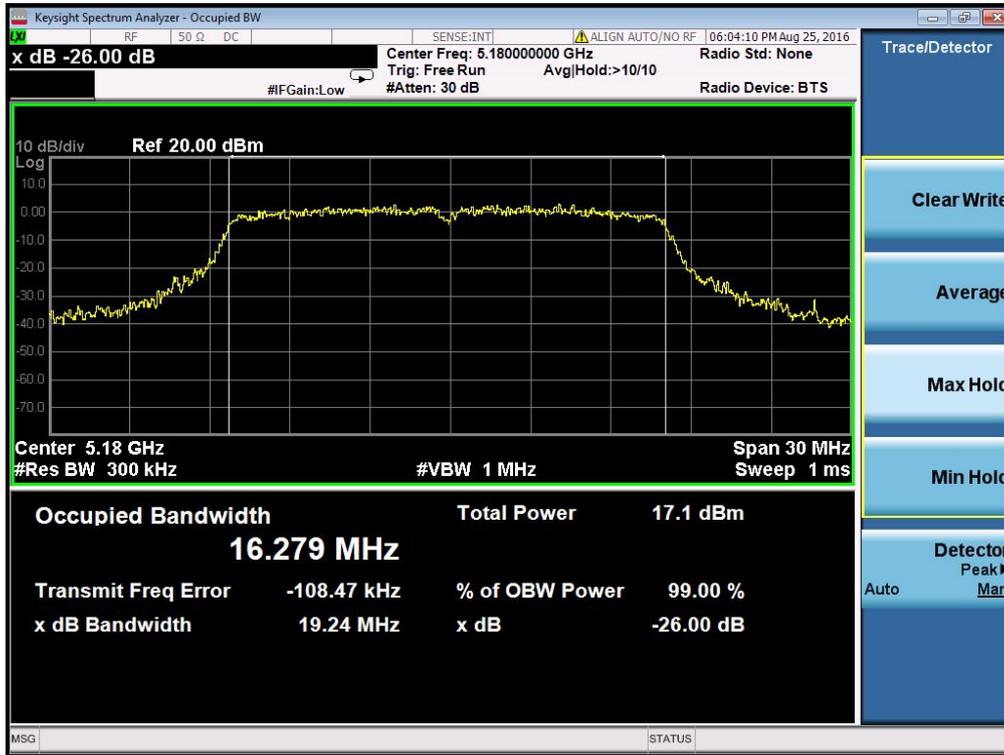
802.11a mode		
Test Frequency (MHz)	26dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5180	19.24	20.24
5220	19.49	18.83
5240	19.93	19.18
802.11n-HT20 mode		
Test Frequency (MHz)	26dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5180	19.66	20.54
5220	19.61	20.20
5240	20.18	20.30
802.11n-HT40 mode		
Test Frequency (MHz)	26dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5190	39.04	39.20
5230	40.72	39.15
802.11ac-VHT20 mode		
Test Frequency (MHz)	26dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5180	20.13	19.67
5220	20.13	19.72
5240	19.68	19.86
802.11ac-VHT40 mode		
Test Frequency (MHz)	26dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5190	39.38	39.11
5230	39.26	39.51
802.11ac-VHT80 mode		
Test Frequency (MHz)	26dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5210	80.64	80.62

Test results of band U-NII-3 (5725 ~ 5850 MHz)

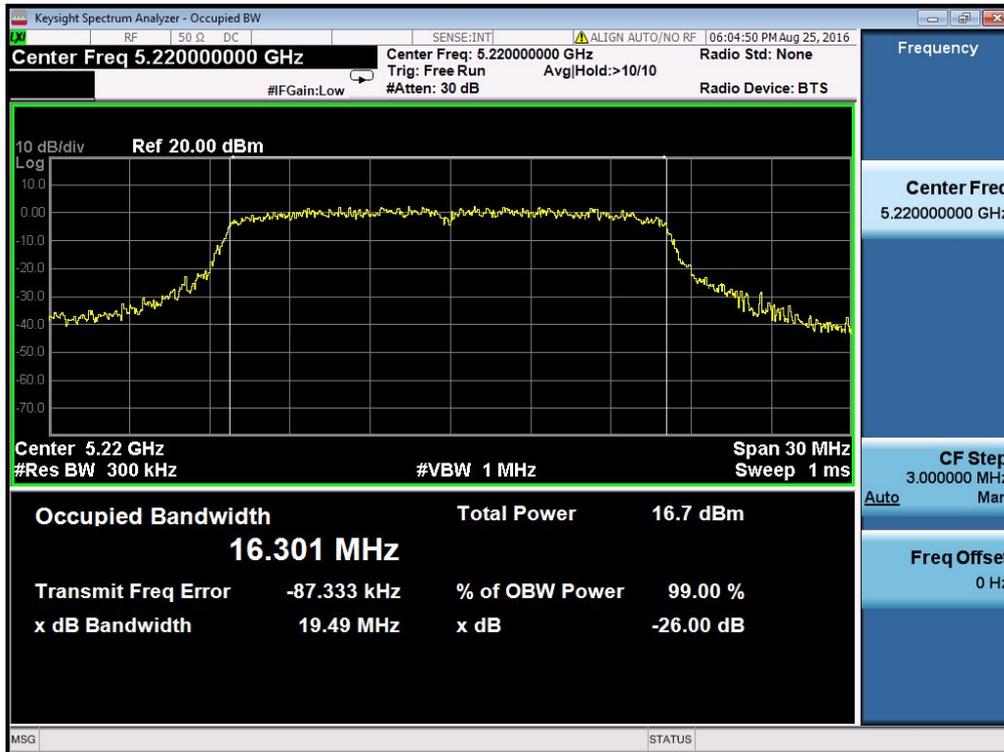
802.11a mode		
Test Frequency (MHz)	6dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5745	15.34	15.08
5785	15.01	15.17
5825	15.35	15.57
802.11n-HT20 mode		
Test Frequency (MHz)	6dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5745	15.93	16.58
5785	16.54	15.14
5825	15.05	15.10
802.11n-HT40 mode		
Test Frequency (MHz)	6dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5755	33.92	32.64
5795	33.81	33.93
802.11ac-VHT20 mode		
Test Frequency (MHz)	6dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5745	15.08	15.08
5785	15.12	15.91
5825	16.29	15.67
802.11ac-VHT40 mode		
Test Frequency (MHz)	6dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5755	33.86	35.14
5795	35.09	35.14
802.11ac-VHT80 mode		
Test Frequency (MHz)	6dB Bandwidth (MHz)	
	Antenna 0	Antenna 1
5775	72.59	70.15

2.3.6. Test Results (plots) of Bandwidth

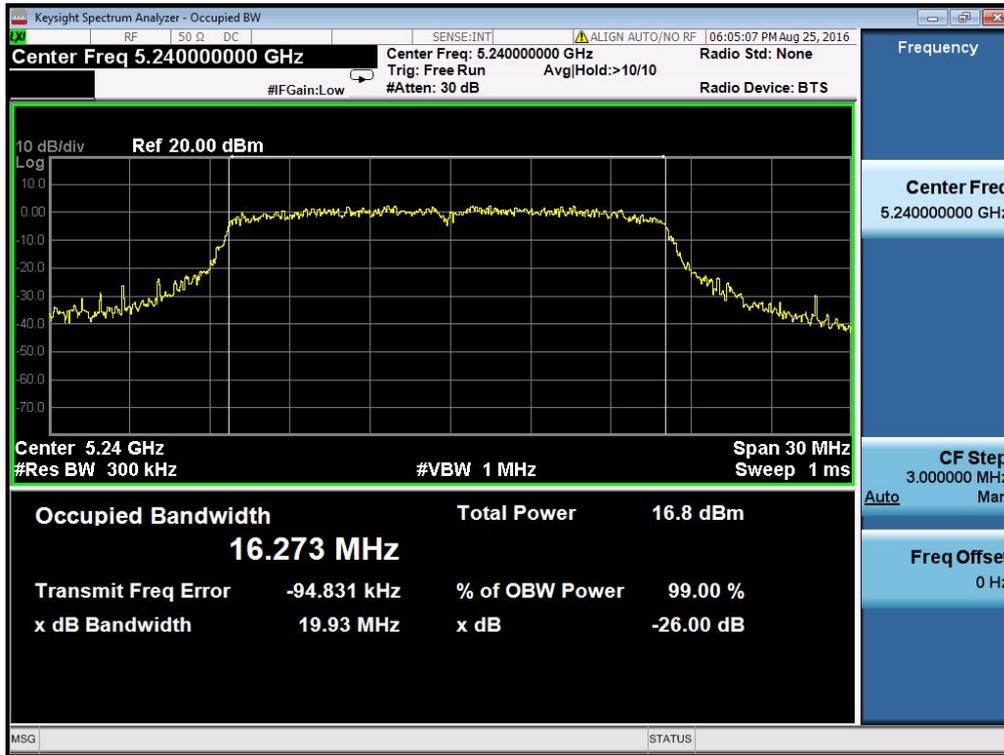
Antenna 0 - 802.11a – 5180MHz



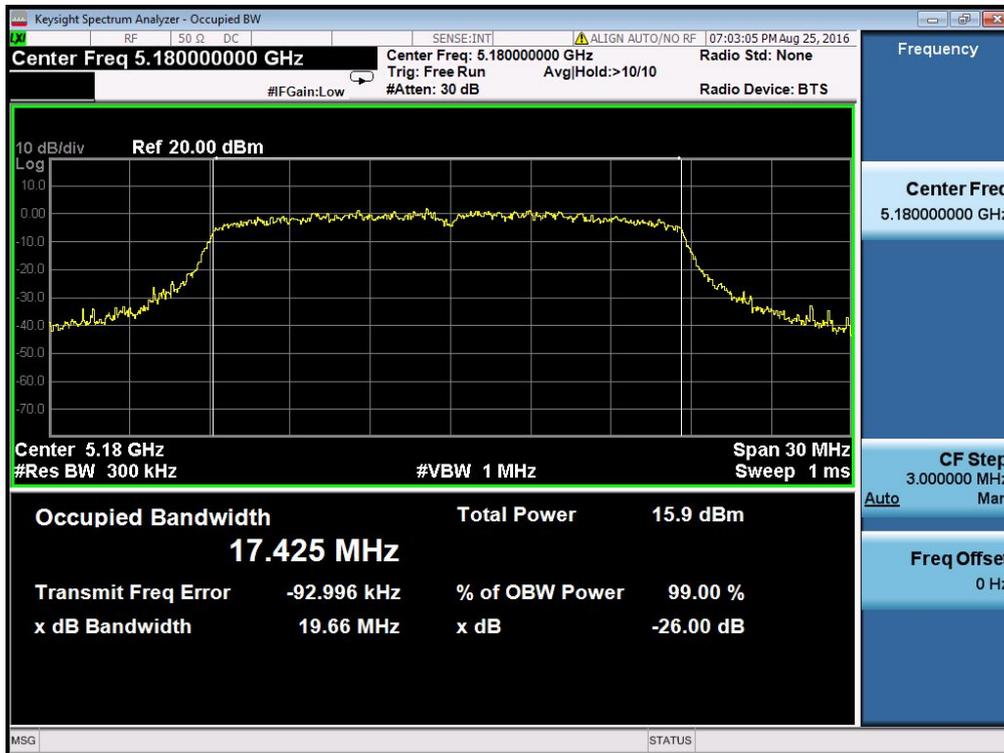
Antenna 0 - 802.11a – 5220MHz



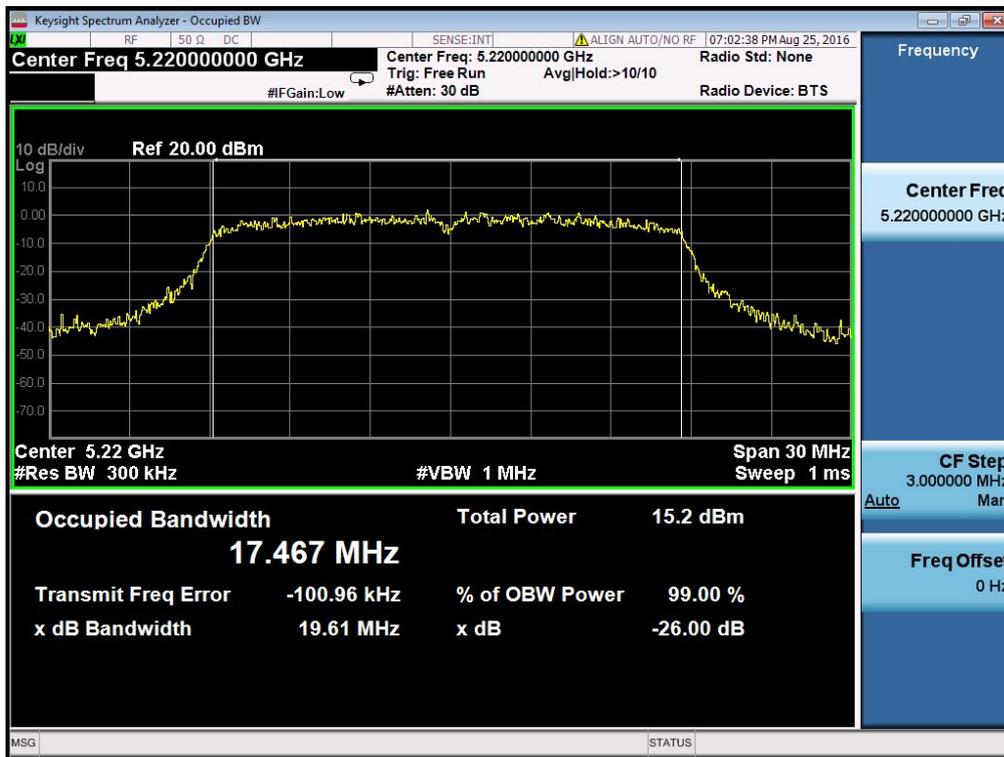
Antenna 0 - 802.11a – 5240MHz



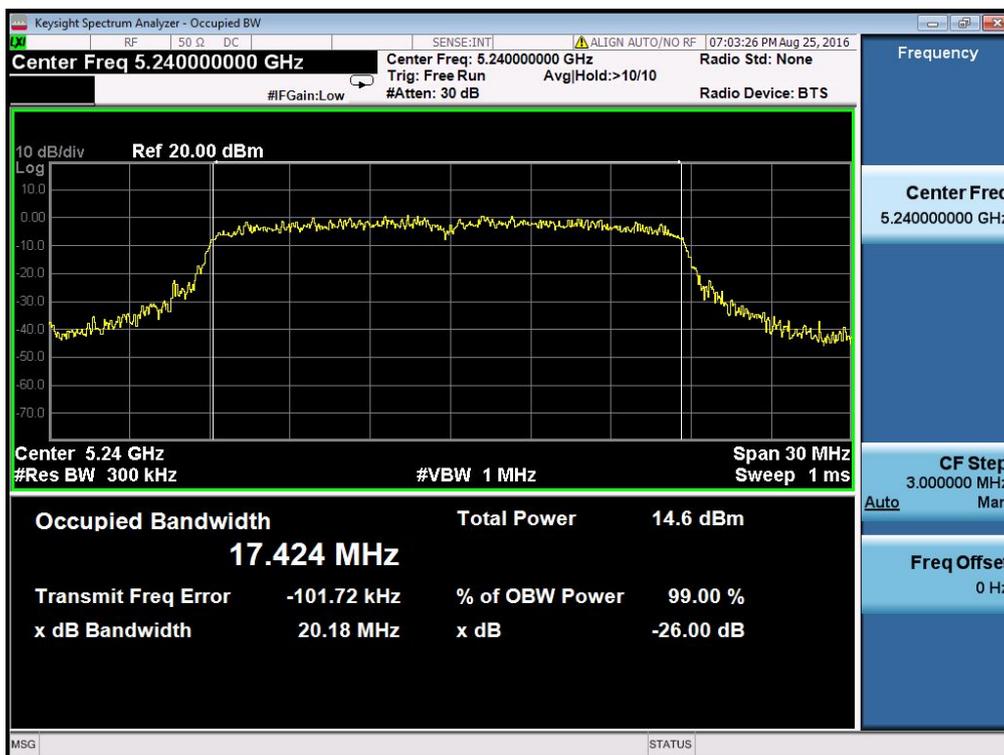
Antenna 0 - 802.11n-HT20 – 5180MHz



Antenna 0 - 802.11n-HT20 – 5220MHz

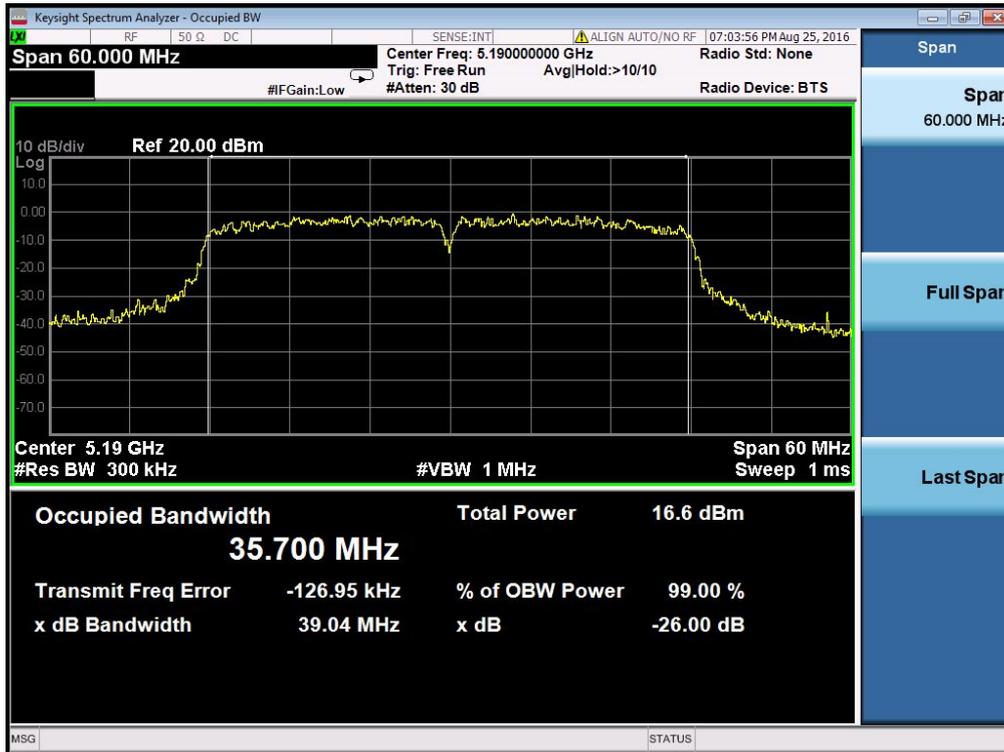


Antenna 0 - 802.11n-HT20 – 5240MHz

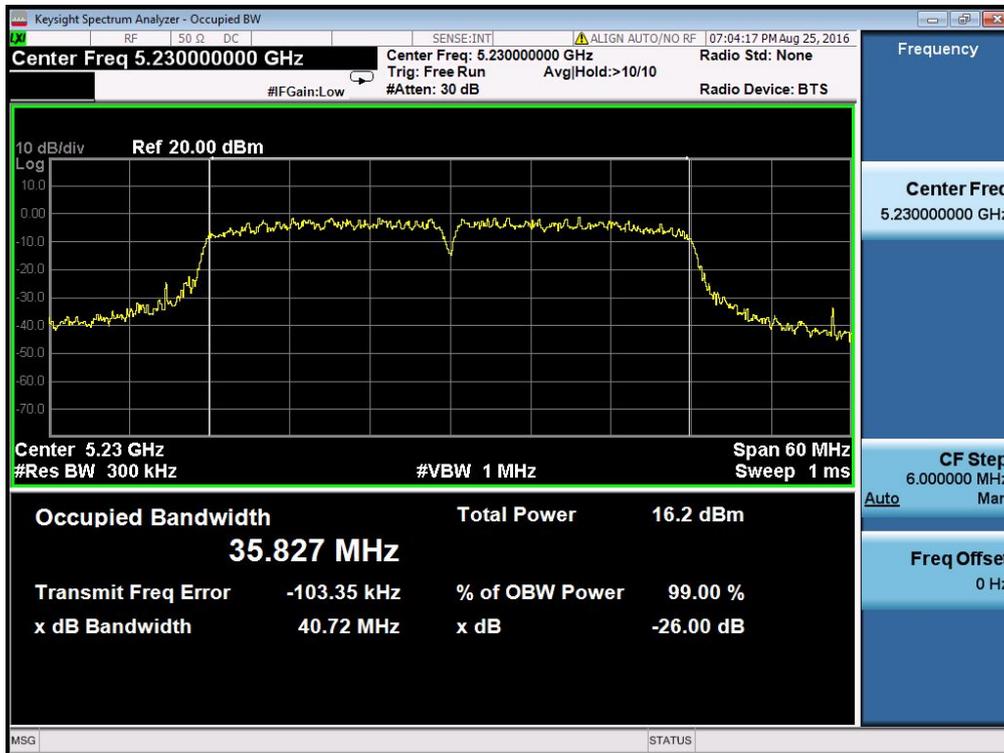




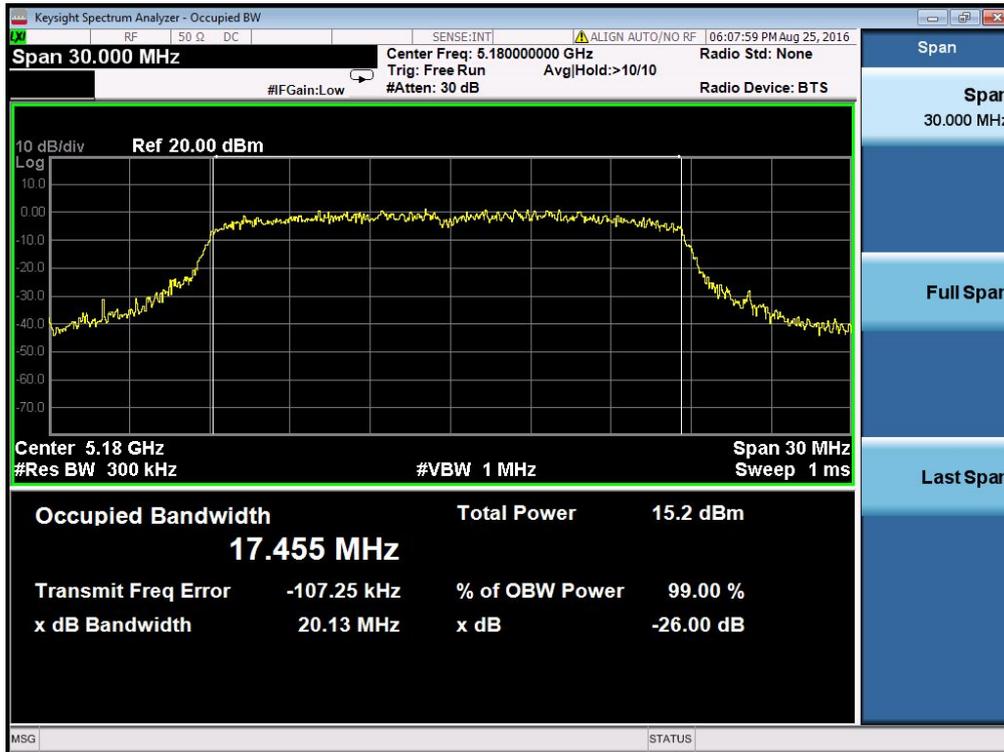
Antenna 0 - 802.11n-HT40 – 5190MHz



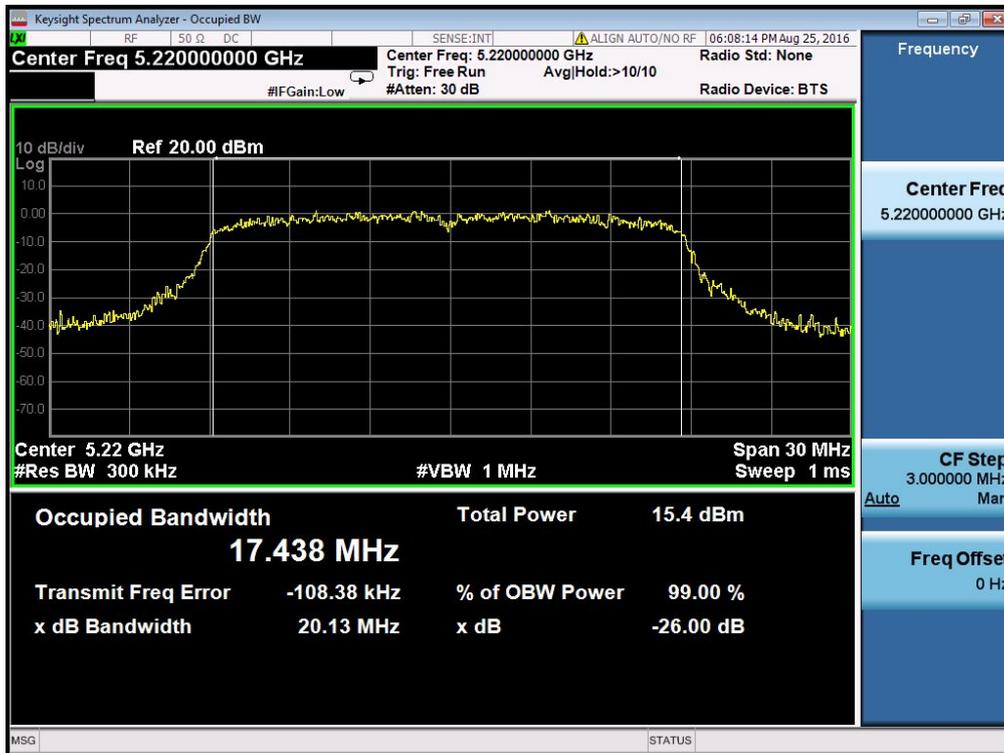
Antenna 0 - 802.11n-HT40 – 5230MHz



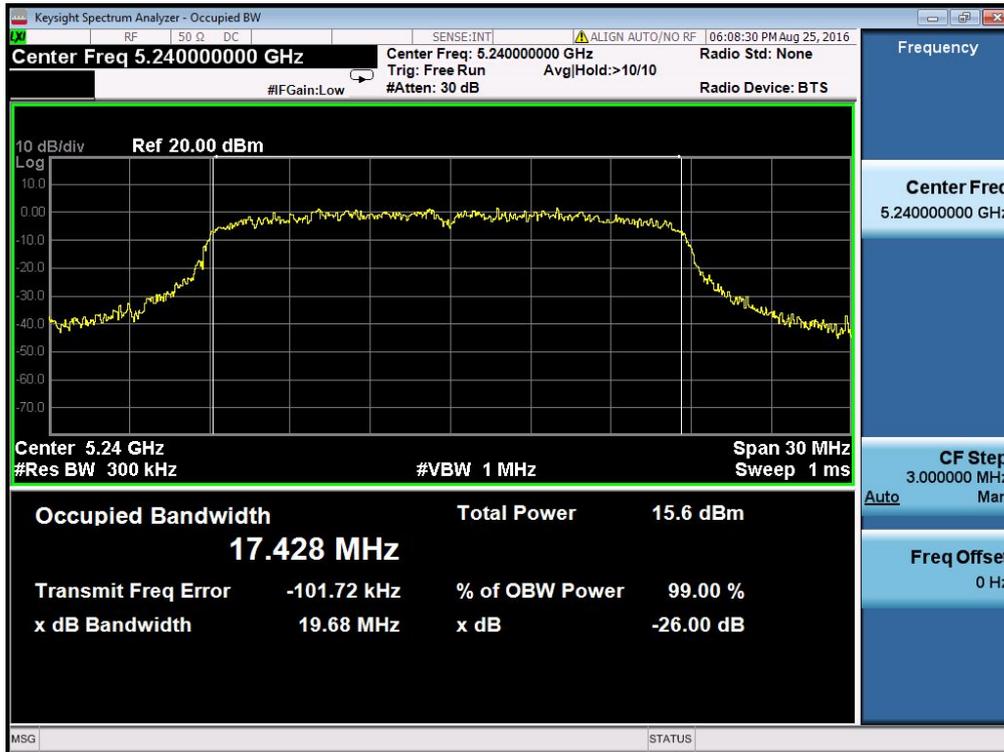
Antenna 0 - 802.11ac-VHT20 - 5180MHz



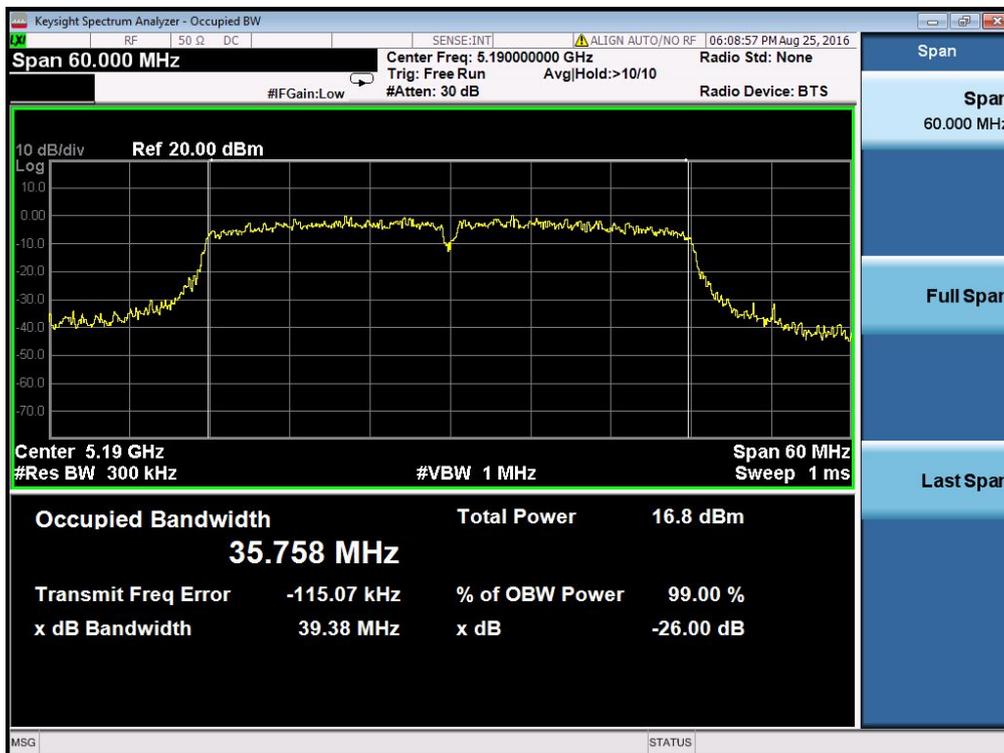
Antenna 0 - 802.11ac-VHT20 - 5220MHz



Antenna 0 - 802.11ac-VHT20 - 5240MHz

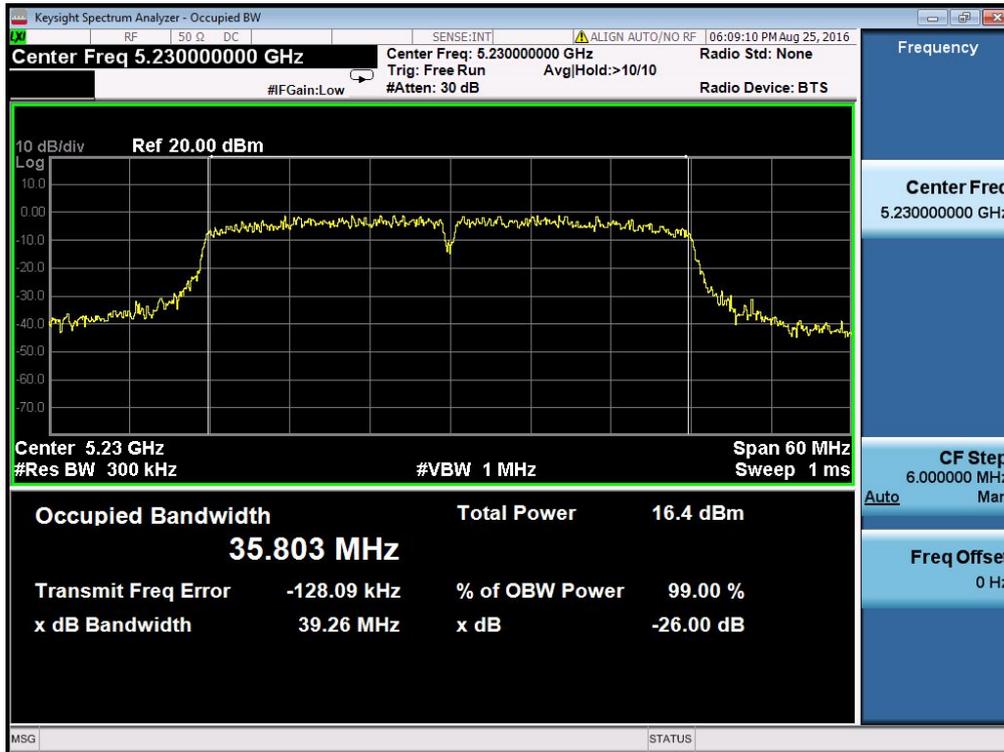


Antenna 0 - 802.11ac-VHT40 - 5190MHz





Antenna 0 - 802.11ac-VHT40 – 5230MHz

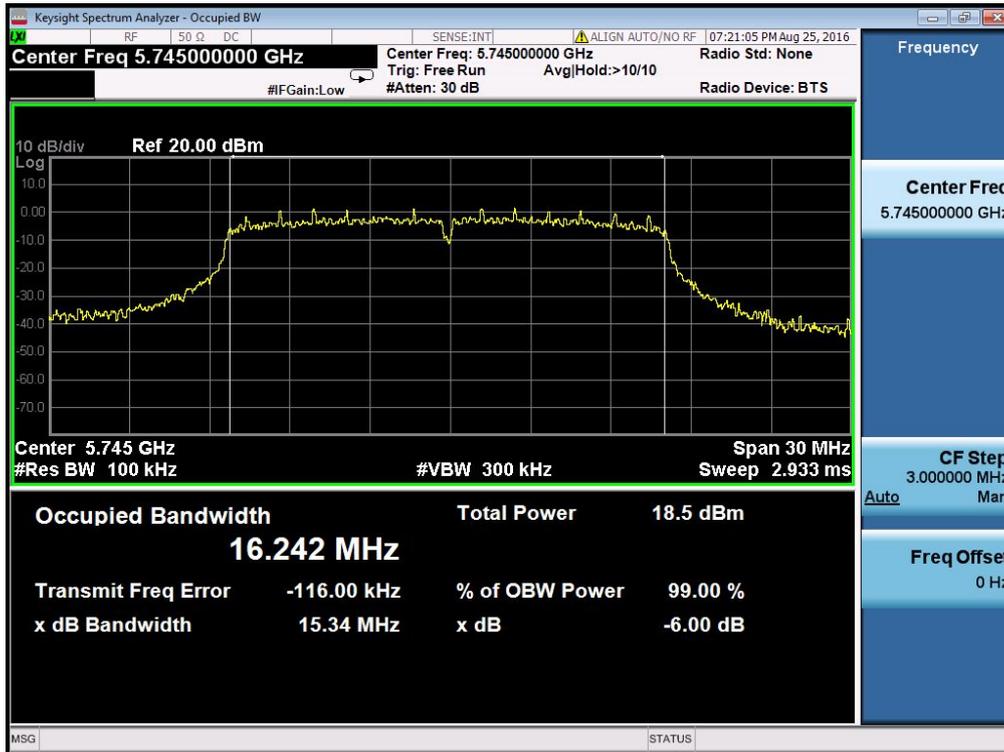


Antenna 0 - 802.11ac-VHT80 – 5210MHz

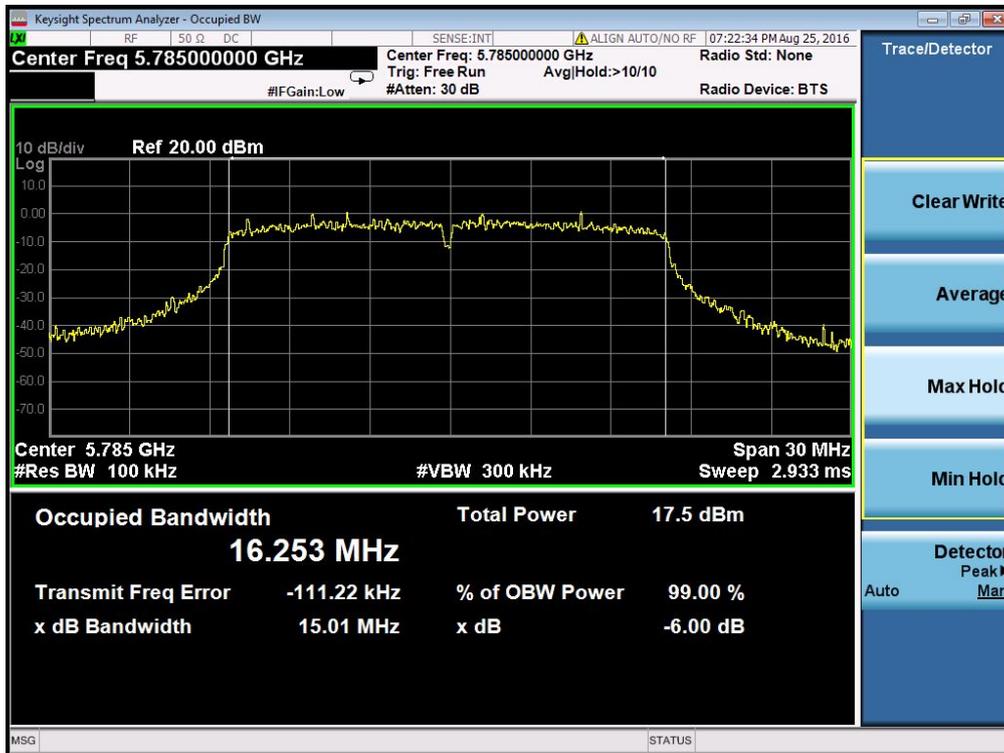




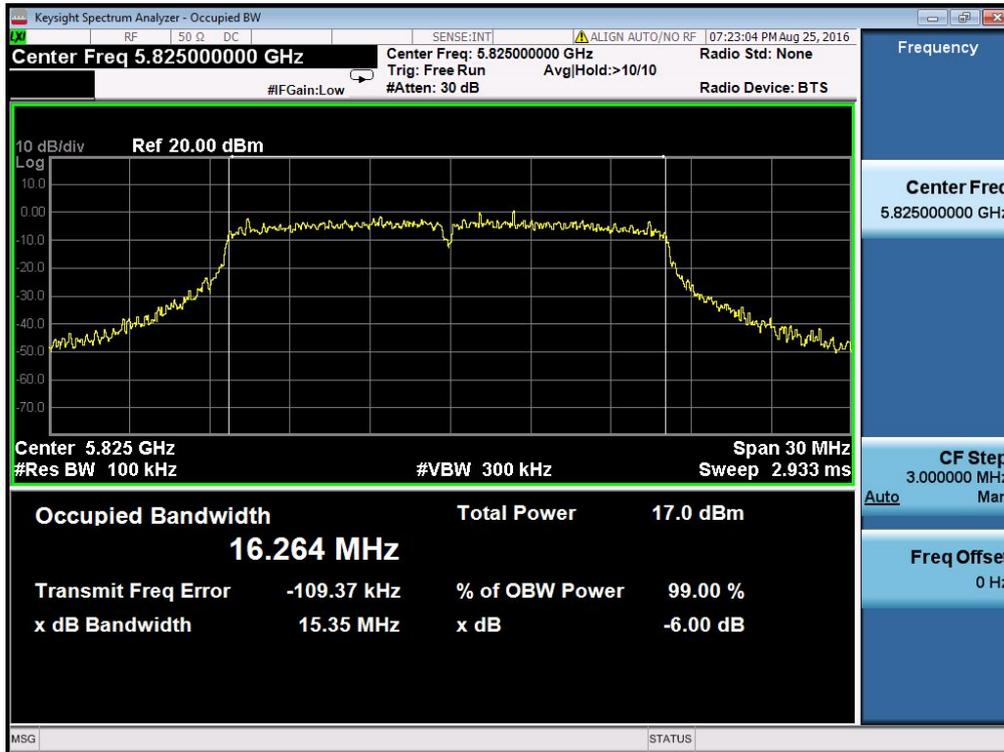
Antenna 0 - 802.11a – 5745MHz



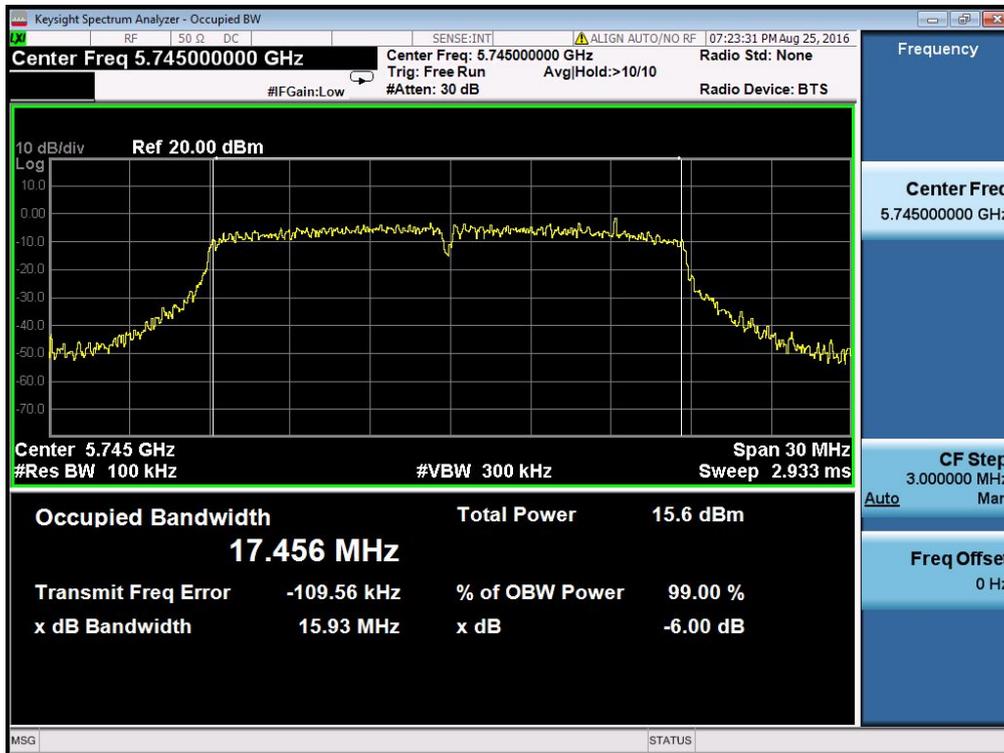
Antenna 0 - 802.11a – 5785MHz



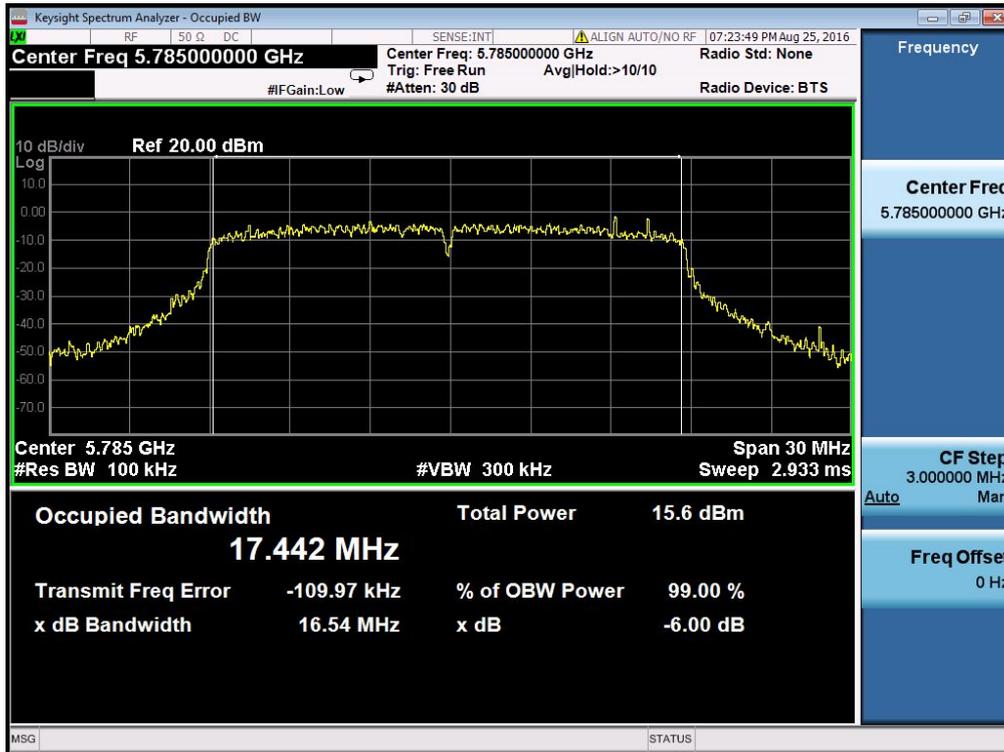
Antenna 0 - 802.11a – 5825MHz



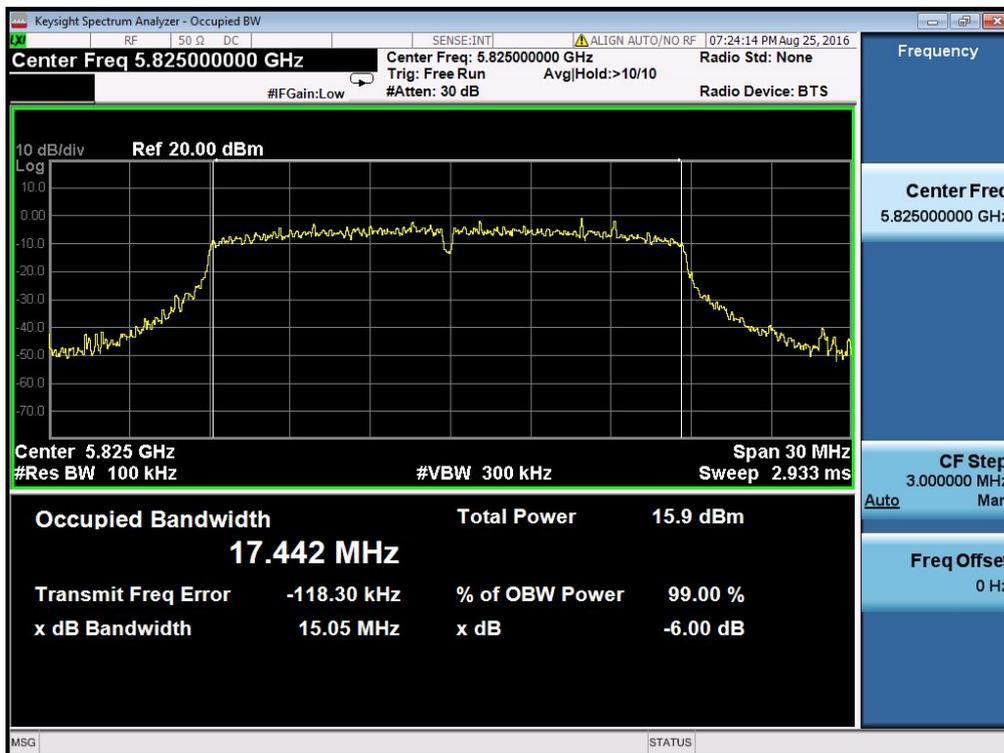
Antenna 0 - 802.11n-HT20 – 5745MHz



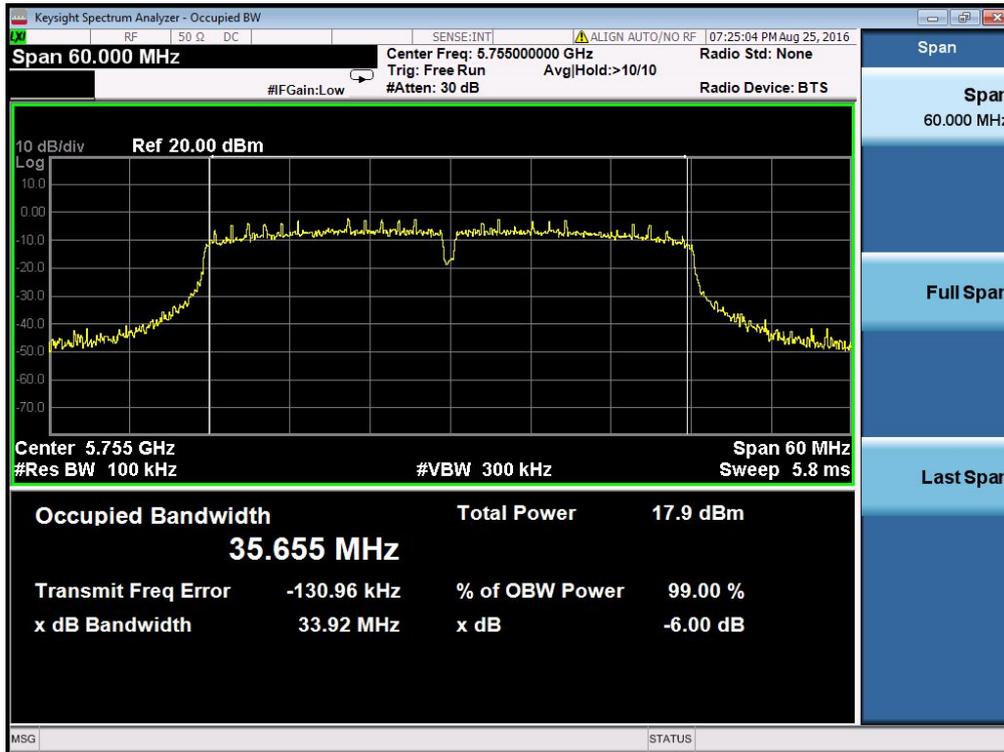
Antenna 0 - 802.11n-HT20 – 5785MHz



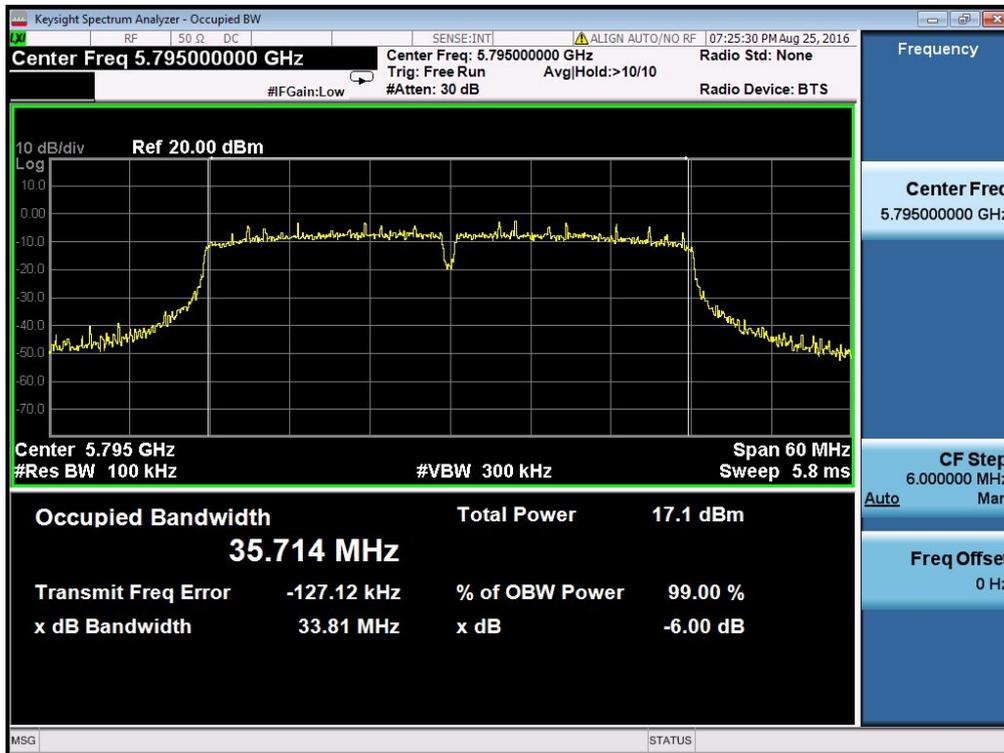
Antenna 0 - 802.11n-HT20 – 5825MHz



Antenna 0 - 802.11n-HT40 - 5755MHz

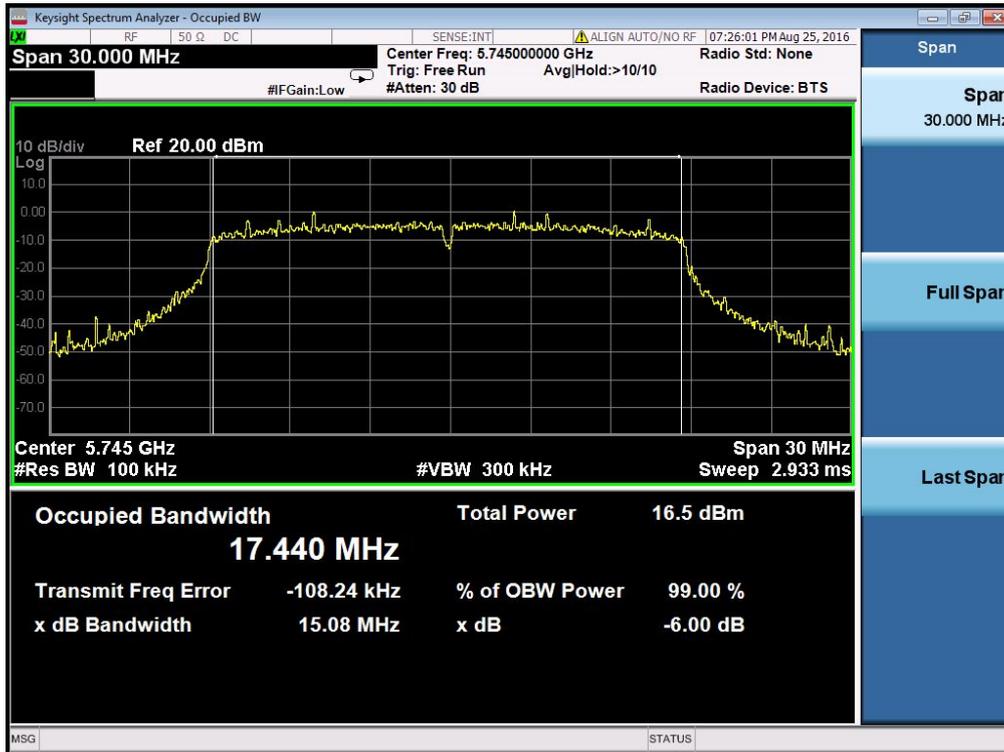


Antenna 0 - 802.11n-HT40 - 5795MHz

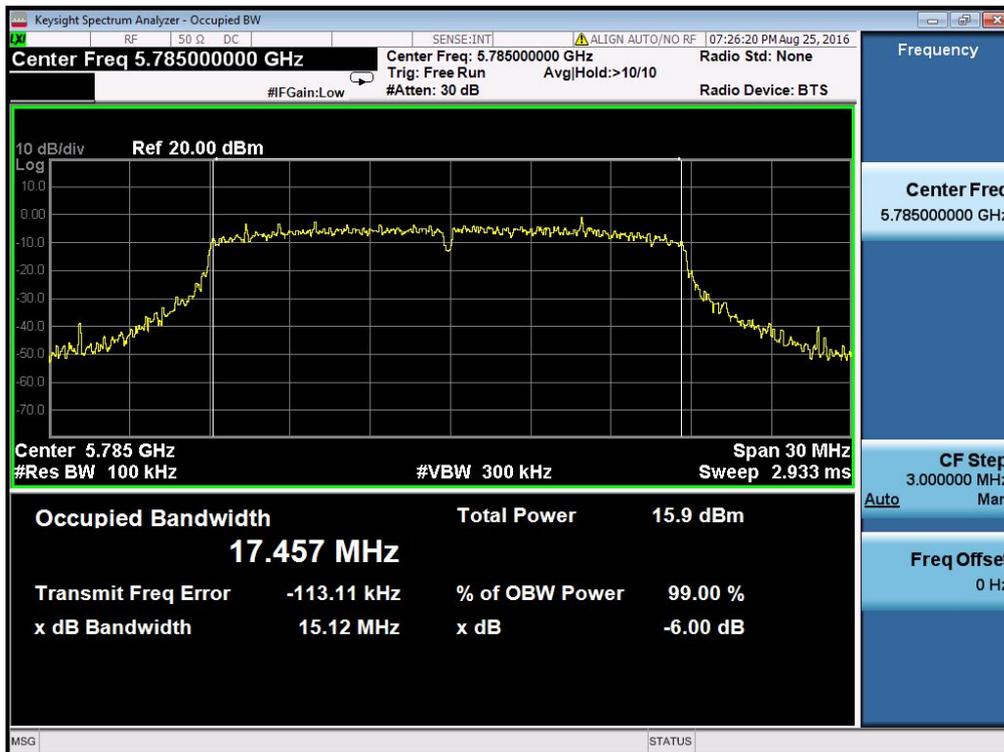




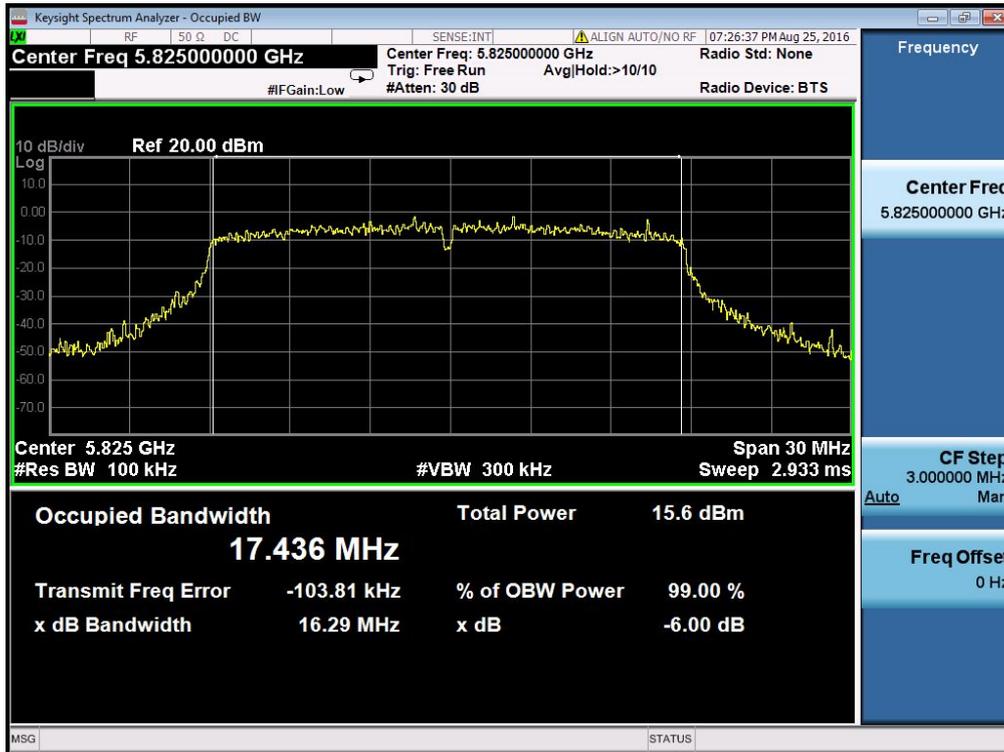
Antenna 0 - 802.11ac-VHT20 - 5745MHz



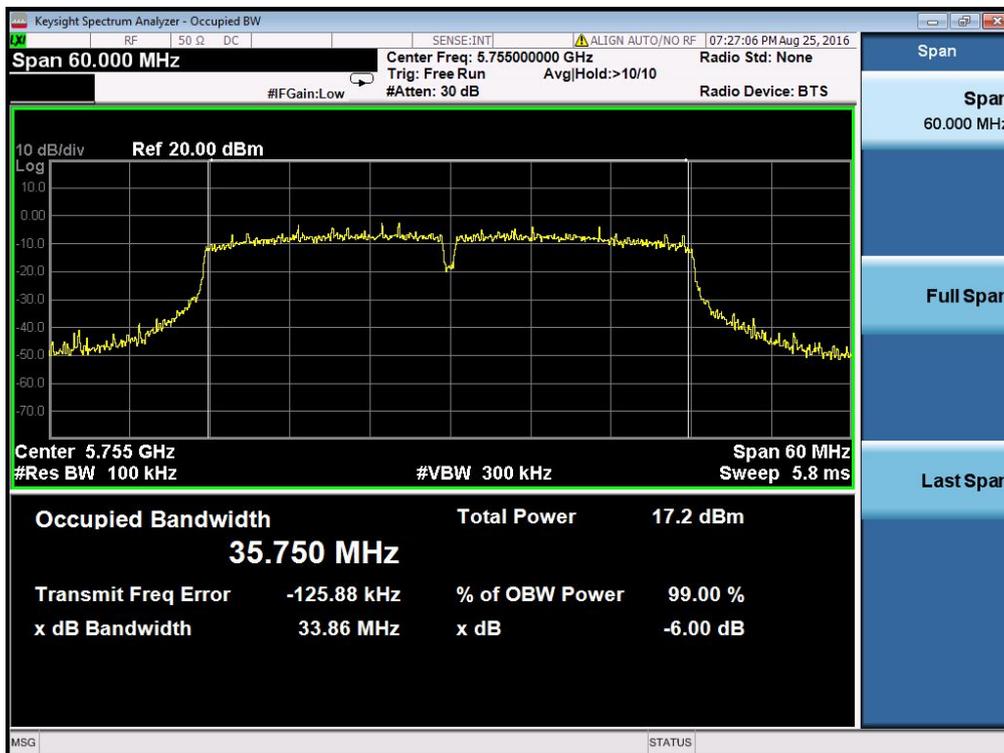
Antenna 0 - 802.11ac-VHT20 - 5785MHz



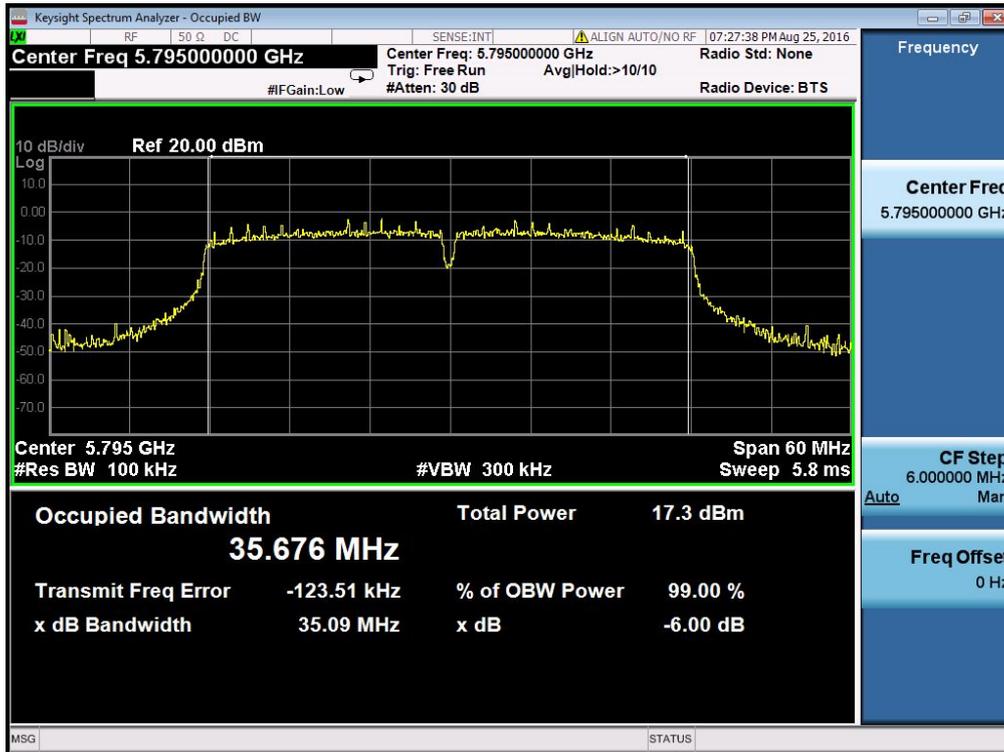
Antenna 0 - 802.11ac-VHT20 - 5825MHz



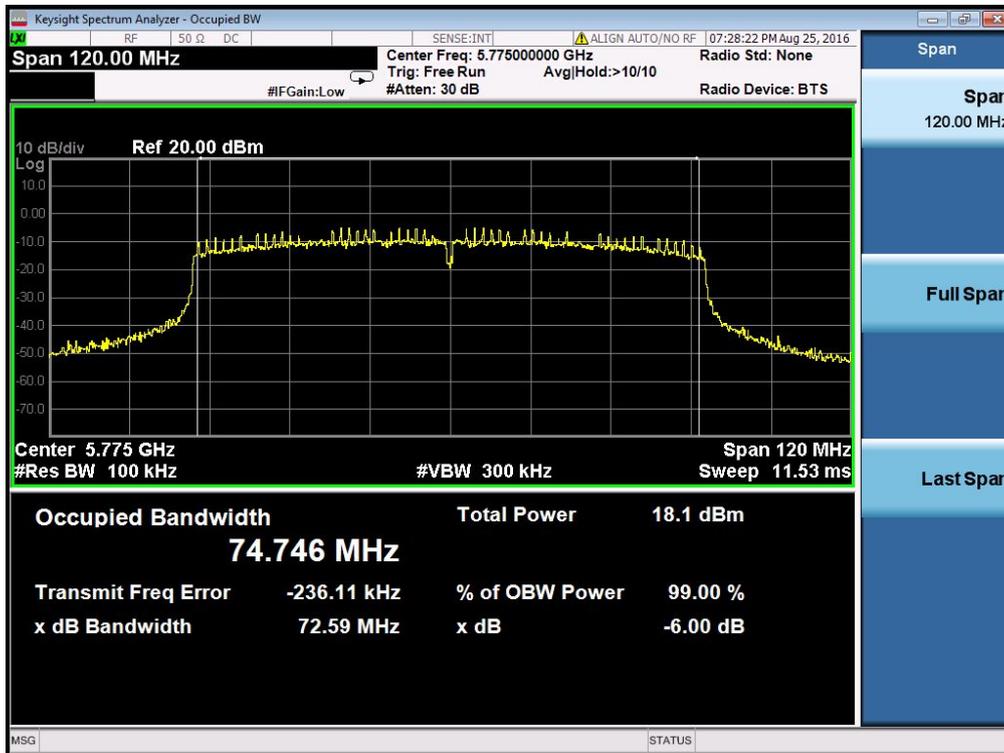
Antenna 0 - 802.11ac-VHT40 - 5755MHz



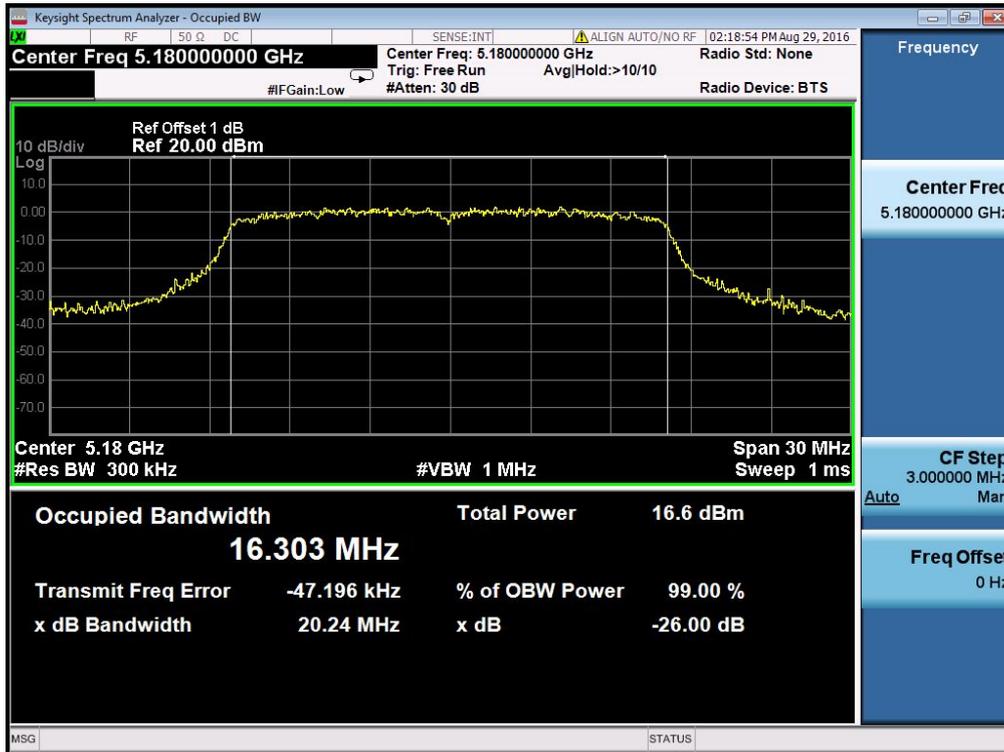
Antenna 0 - 802.11ac-VHT40 – 5795MHz



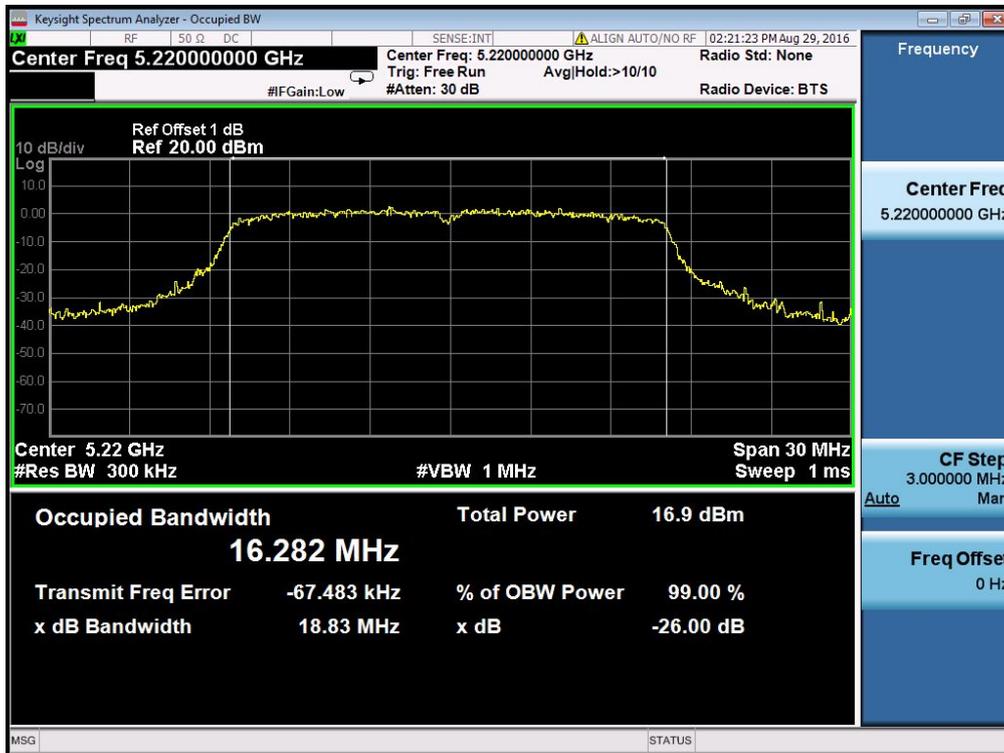
Antenna 0 - 802.11ac-VHT80 – 5775MHz



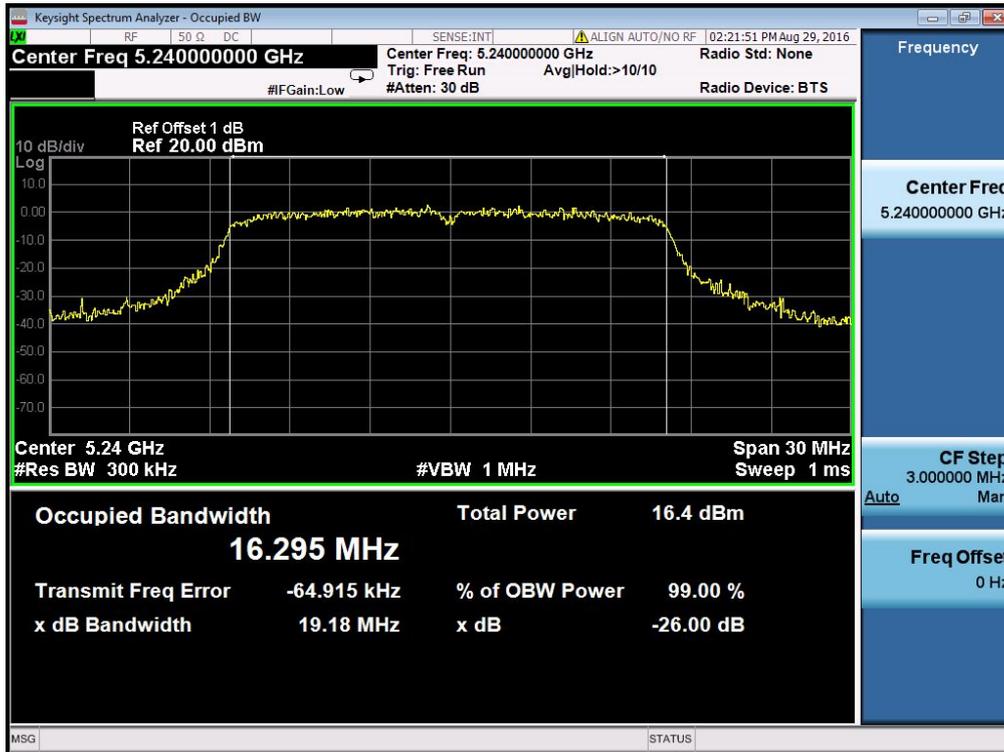
Antenna 1 - 802.11a – 5180MHz



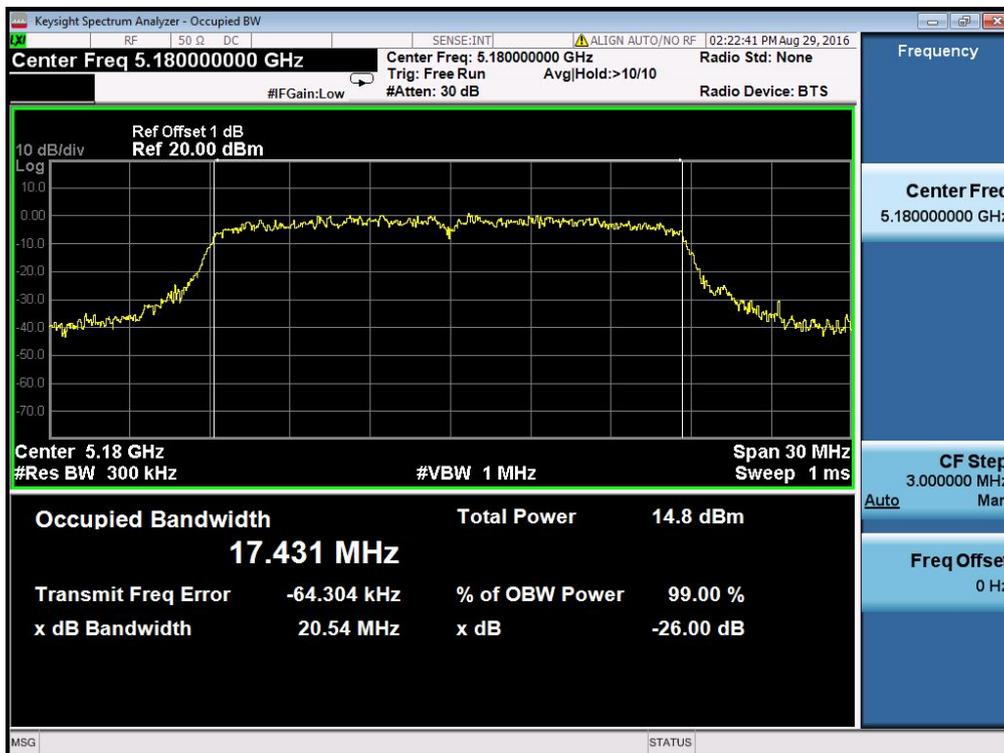
Antenna 1 - 802.11a – 5220MHz



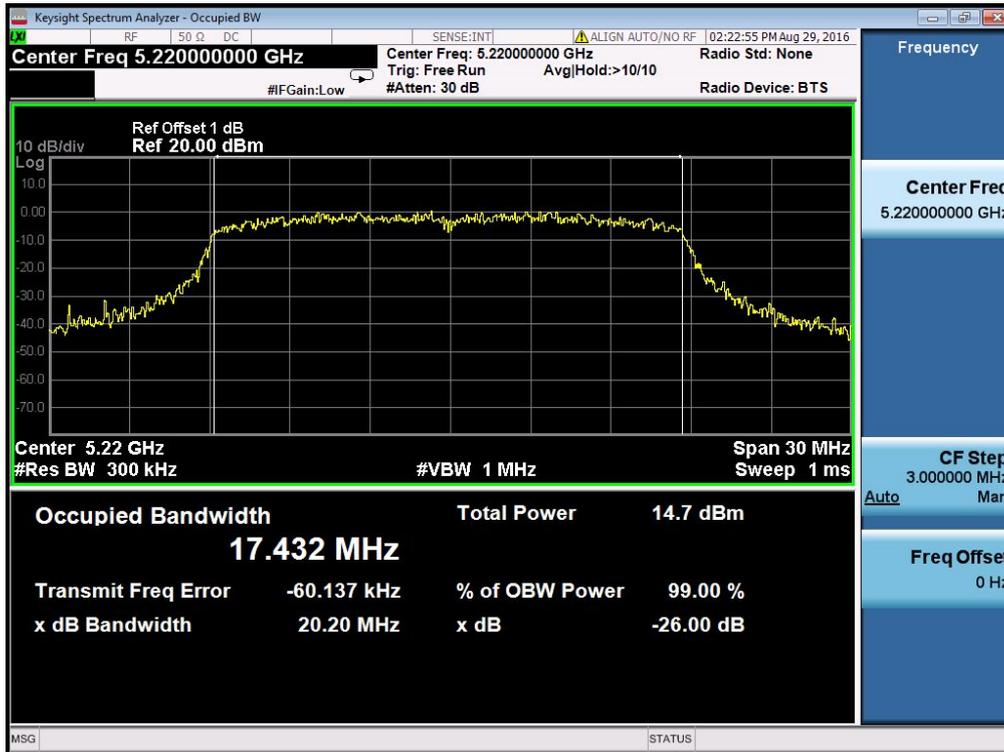
Antenna 1 - 802.11a - 5240MHz



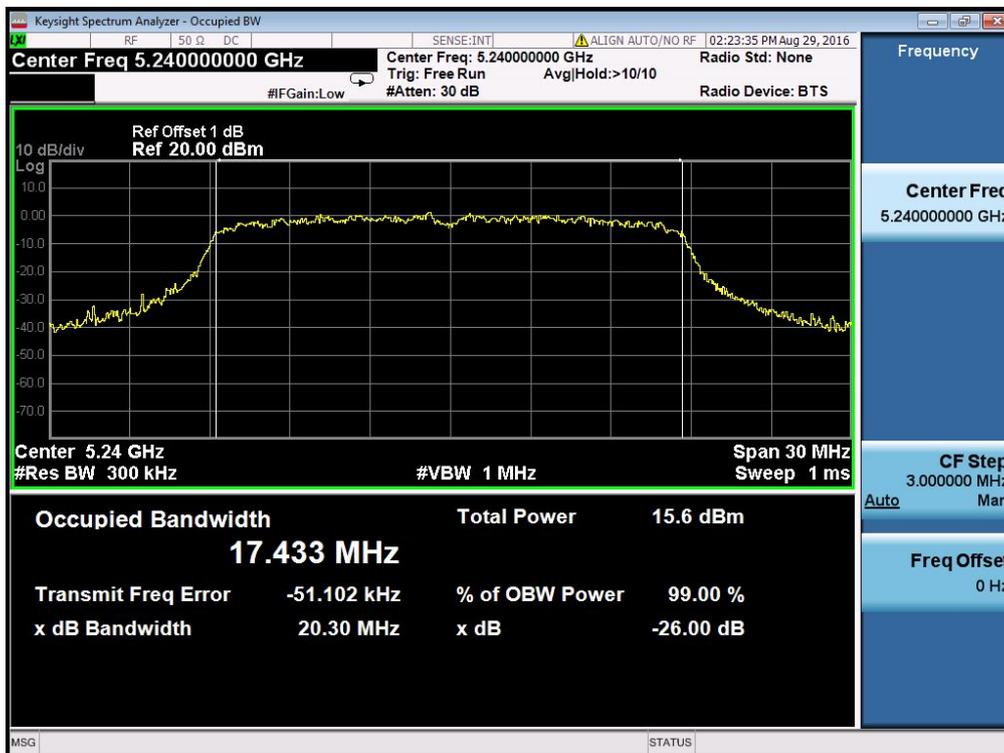
Antenna 1 - 802.11n-HT20 - 5180MHz



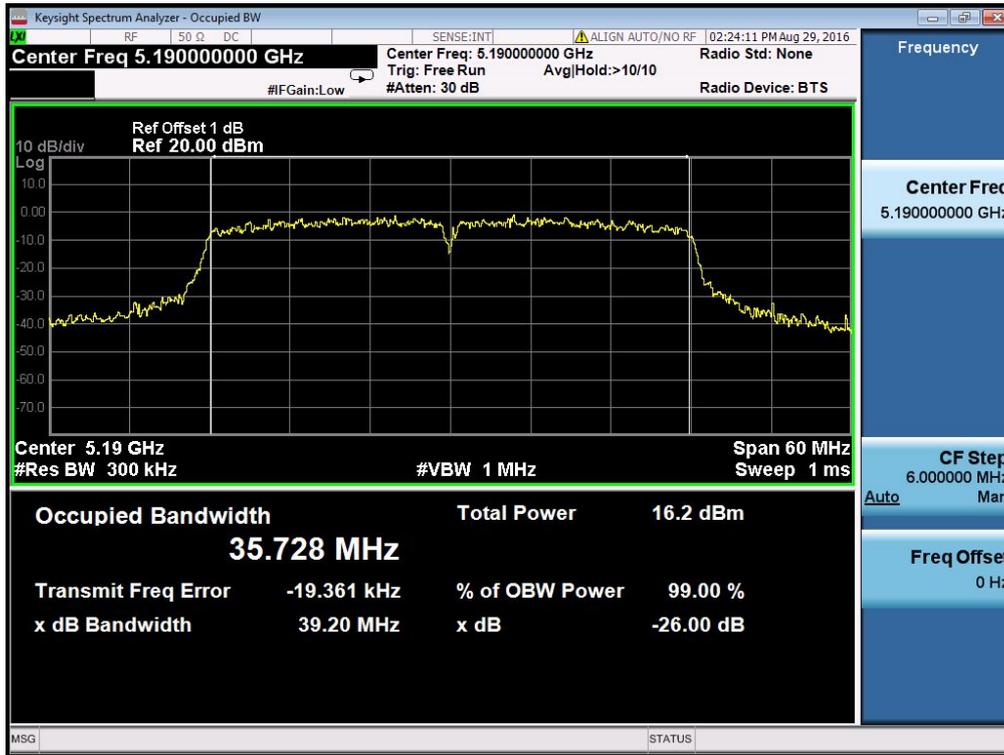
Antenna 1 - 802.11n-HT20 – 5220MHz



Antenna 1 - 802.11n-HT20 – 5240MHz



Antenna 1 - 802.11n-HT40 – 5190MHz



Antenna 1 - 802.11n-HT40 – 5230MHz





Antenna 1 - 802.11ac-VHT20 - 5180MHz



Antenna 1 - 802.11ac-VHT20 - 5220MHz

